

A Comparative Study Between Endoscopic Middle Meatal Antrostomy and Caldwell-Luc Surgery in the Treatment of Chronic Maxillary Sinusitis

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Abstract Functional endoscopic sinus surgery (FESS) has almost completely replaced the radical Caldwell-Luc approach. About 20 years after its origin of FESS a comparative study with Caldwell-Luc Surgery (C-L) definitely should be on cards to validate the previous results. To compare the effectiveness of endoscopic middle meatal antrostomy and Caldwell-Luc's surgery in the management of Chronic Maxillary Sinusitis. This is a prospective randomized comparative study based on the analysis of eighty patients who were diagnosed to have chronic, unilateral, maxillary sinusitis and underwent surgery, after a failed trial of conservative management. One year after surgery 44% of the C-L patients and 89% of the FESS patients reported distinct improvement of their symptoms. Both are effective in the management of chronic sinusitis. Endoscopic middle meatal antrostomy is superior to Caldwell-Luc in intraoperative and postoperative parameters.

Keywords Maxillary sinusitis · Middle meatal antrostomy · Calwell-Luc's surgery

Introduction

Endoscopic sinus surgery was developed in continental Europe in the 1970s and 1980s [1–6]. Despite great claims for the technique, there had been fewer controlled trial of FESS versus conventional surgery. Success rates of around 90% have been reported using the old “unphysiological” operation of inferior meatal antrostomy in cases of

recurrent acute and chronic sinusitis [7]. Reported success rates for endoscopic surgery are similar [8]. Arnes et al. [9] found no difference in their trial of inferior versus middle meatal antrostomy. One randomized controlled trial of FESS against Caldwell-Luc has been reported from Finland [10] in which the FESS group did marginally better and had fewer side-effects than the Caldwell-Luc group. Maran has presented some data on a symptom of nasal stuffiness. Interim results of a controlled trial by Fairley [11] revealed no difference in outcome between FESS and INA.

Caldwell-Luc operation was and is still a commonly done operation for certain maxillary sinus problems. The majority of these indications still remain, though for problems related to the ethmoids and the sphenoid, FESS has taken over. However, with the endoscopic method it is still not possible to see the complete sinus unless it is combined with a sinusotomy through canine fossa which almost mimics a Caldwell-Luc's surgery.

Materials and Methods

Eighty patients who were diagnosed to have chronic, unilateral, maxillary sinusitis according to the Rhinosinusitis Task Force Criteria (RSTF) [12], who underwent surgery, after a failed trial of conservative management for a minimum period of 6–8 weeks during the period of June 2005–August 2006 were selected in our study.

Study groups comprised of patients who met the following criteria. (1) Patients with history suggestive of chronic, unilateral, maxillary sinusitis. (2) Patients with chronic headache of more than 12 weeks duration and radiological evidence of unilateral maxillary sinusitis. (3) Patients with recurrent antrochoanal polyp. Patients with maxillary sinusitis caused by structural causes such as deviated nasal

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septum, concha bullosa, sinusitis of dental origin, sinusitis caused by oroantral fistula were excluded from the study.

Prior nasal endoscopy was also done in all cases. A preoperative CT scan of the nose and paranasal sinuses was taken.

Preoperative Preparation

1. Control of infections and allergy
2. Preoperative steroids
3. Control of systemic illness
4. Routine and relevant investigations

80 cases of chronic maxillary sinusitis selected were then randomly allocated into two groups of 40 each.

1. Group I: Those undergoing endoscopic middle meatal antrostomy
2. Group II: Those undergoing Caldwell-Luc's surgery. (Both with or without polypectomy)

All these patients had preoperative counseling. All operations were done under local anaesthesia and were put on intravenous antibiotics and other symptomatic measures. Group I patients were usually discharged on the next/second postoperative day and Group II once the gross oedema decreases. On the third postoperative day, the clots, secretions and crusts were carefully removed from the surgical site by suction. This will prevent the formation of scabs and fibrin bridges which can later contribute to synechiae formation. The cavity care is given on the next visit, i.e., after 2 weeks of surgery. Endoscopic cleaning of the cavity is done during the first visit in which the crusts, clots, and the polyps are removed. Synechiae if present are released and a small piece of silastic stent is kept in the nasal cavity for 7–10 days to prevent reformation of the synechiae. Antibiotics, antihistamines, steroids were given as and when required. The next visit is 1 month after the surgery when again the subjective and endoscopic evaluation is done. Frequent follow up is done and a cavity care is given in each visit till reepithelialisation of the cavity is completed. This usually takes 2–3 weeks, but may be prolonged even up to 8 weeks. We had in our study a follow up to 12 months.

Results and Analysis

40 patients underwent conventional Caldwell-Luc's operation and 40 patients underwent endoscopic middle meatal antrostomy.

The most common presenting symptom in both groups was headache followed by nasal discharge and nasal obstruction. Prior nasal endoscopy showed no statistically

significant difference in the occurrence of oedema and discharge in the middle meatus. Majority of patients in both groups were found to have sinonasal polyposis in preoperative CT. The most common comorbid factor in both groups of patients was allergic rhinitis. The following variables were analyzed to compare the effectiveness of the two surgical procedures.

1. Days of hospital stay
2. Preoperative variables such as bleeding, cooperation of the patients, type of nasal packing and comfort of the patient in the immediate post-operative period (Table 1)
3. Post-operative symptomatic relief of the patients.
4. Post-operative improvement in the nasal endoscopy findings
5. Analysis of complications and need for revision surgery

Postoperative assessment of symptoms

1. Facial pain: After 1 month of surgery, facial pain was significantly decreased in the FESS group compared to the Caldwell-Luc's group.
2. Nasal obstruction: 82.5% of the patients had nasal obstruction preoperatively. However, the severity of the nasal obstruction showed a steadily decreasing trend (of statistical significance) in both groups from 3rd day to 12 months after surgery.
3. Nasal discharge: 88.75% of the analyzed patients had nasal discharge preoperatively. However, the severity of the nasal discharge showed a steadily decreasing trend (of statistical significance) in both groups from 3rd day to 12 months after surgery.
4. Headache: At any time in the postoperative period (up to 12 months) headache was significantly less in patients who underwent FESS when compared to Caldwell-Luc surgery. However, the severity of headache showed a steadily decreasing trend (of statistical significance) in both groups from 3rd day to 12 months after surgery.
5. Halitosis: Halitosis after 1 month of surgery was significantly increased in the Caldwell-Luc group compared to FESS group.
6. Dental pain: No statistically significant difference between the two groups with respect to the incidence of dental pain 1 month after surgery.
7. Hyposmia/anosmia: After 1 month of surgery, hyposmia/anosmia was significantly decreased in the FESS group compared to Caldwell-Luc group.
8. Ear pressure: Relief of ear pressure after 1 month of surgery was significantly more in the FESS group when compared to the Caldwell-Luc's group.

Table 1 Preoperative and postoperative variables

Variables	Groups	Sample size	No. of patients			Z value	P value
			Cooperative	With AN pack	Comfortable		
Co-operation of patients	I	40	33			3.90	<0.01
	II	40		16			
Type of nasal packing	I	40		12		−6.56	<0.01
	II	40		40			
Patient comfort (Immediate post-op)	I	40			27	+5.02	<0.01
	II	40			5		

9. Epistaxis: Epistaxis 1 month after surgery was significantly increased in the FESS group compared to Caldwell-Luc group i.e, it was better relieved by Caldwell-Luc surgery.

Complications

- Crusts in the middle meatus: From the analysis it is seen that crust formation in the FESS group at 2 weeks and 1 month after surgery was more than the Caldwell-Luc group with a high statistical significance, but at 6 months after surgery it was more in the Caldwell-Luc's group.
- Synechiae: It is seen that there is no statistically significant difference between the two groups with respect to the formation of synechiae after surgery.
- Cheek Oedema: There was significant occurrence of cheek oedema in the Caldwell-Luc group at 3 days and 2 weeks after surgery. But this occurred in none of the FESS surgery group.
- Infraorbital numbness/neuralgia: there was statistically significant incidence of numbness/neuralgia at the end of 3 days, 2 weeks and 1 month in the Caldwell-Luc group. None of our FESS patients developed this symptom after surgery.
- Polyp in middle meatus: There was significant occurrence of polyps at the end of 2 weeks in both groups while after that there was greater incidence of polyps in Caldwell-Luc group than FESS group
- Oedema of middle meatus: There was significant occurrence of oedema in the middle meatus at the end of 2 weeks in FESS group than Caldwell-Luc group, but at the end of 1 and 6 month there was increase in incidence of oedema in Caldwell-Luc group compared to FESS group
- Discharge in middle meatus: No significant discharge in middle meatus at the end of 2 weeks in both group. But at the end of 1 and 6 month after here was increased occurrence of discharge in the Caldwell-Luc group when compared to the FESS group.

Discussion

In our study the most common complaint was headache (97.5%), followed by nasal discharge (88.75%) and nasal obstruction (82.5%). The other symptoms were facial pain (50%), facial congestion and fullness (7.5%), anosmia/hyposmia (38.25%), purulent rhinitis (16.25%), fever (11.25%), halitosis (65%), Fatigue (6.25%), dental pain (55%), ear pressure (32.5%), epistaxis (37.5%) and cough (13.75%). These symptoms were classified as major and minor according to the Rhinosinusitis task force criteria. The majority of the patients were suffering from nasal discharge and facial pain in Howard Levine's [13] study.

On nasal endoscopy, 77.5% of our patients were found to have sinonasal polyposis, 93.75% had oedema of the middle meatus and 92.5% had discharge in the middle meatus. All of our patients underwent preoperative CT scan of the nose and paranasal sinuses with limited 2 mm coronal and axial cuts. 22.5% were found to have partial opacification of the maxillary sinus, 25% had complete opacification and remaining 52.5% had opacity extending into the nasal cavity suggestive of sinonasal polyposis.

Both the surgeries were done under local anaesthesia. Bleeding was almost normal in both groups in our study except for two patients in the Caldwell-Luc group. The best way to avoid intraoperative haemorrhage is to prepare the patient carefully. The blood pressure should be normalized. Infections if present should be treated with appropriate antibiotics. Associated nasal allergy and extensive sinusal diseases need preoperative steroids. Preoperative nasal packing with 4% Xylocaine mixed with 1 in 1000 adrenaline, reverse Trendelenberg position during surgery, infiltration anaesthesia with 1% Xylocaine mixed with 1 in 2 lakhs adrenaline, usage of suction cautery and use of through cut instruments help to decrease the bleeding. If general anaesthesia is planned, it is better to have hypotensive anaesthesia. Careful, atraumatic surgical techniques also minimize the bleeding. (Stammberger) [5] When the two groups were compared with respect to the cooperation during surgery it was found that there was significant

increase in the number of co-operating patients in Middle meatal antrostomy group than Caldwell-Luc group. This may be due to the fact that under local anesthesia, bone work as well as the retraction of the soft tissues of cheek to expose the maxillary antrum in the Caldwell-Luc's surgery may not be tolerated by many of the patients. In addition to this the intraoral work makes it difficult for the patient to communicate with the surgeon during Caldwell-Luc's procedure which is easier in FESS. Inadequacy of the nerve block inside the antral mucosa makes the patient more non cooperative. The time taken for the procedure is found to be more in Caldwell-Luc group when compared to FESS group. In a study conducted by Ikeda et al. [14] it was found that the cooperation of patients was much better in the FESS group as compared to the Caldwell-Luc's surgery group. In our study anterior nasal packing with medicated ribbon gauze was done in only 12 patients of middle meatal antrostomy, while an antral pack brought out via the inferior meatal antrostomy opening was done in all patients of Caldwell-Luc. In middle meatal antrostomy, we preferred putting compressed absorbable gelfoam into the antrostomy site. This was enough to control the bleeding and to prevent adhesions. In 12 cases there was still minimal oozing and so we did anterior nasal packing. It is better to avoid tight packing of the antrostomy sites in both surgeries because once opposing raw areas are created there is every chance of formation of adhesions in the postoperative period which will cause recurrence of the preoperative symptoms. According to Stammberger [5], there is no need for packing the middle meatus or nose at the end of FESS since there is little chance of bleeding. At the end of the surgery the surgical area is examined with the endoscope and clots if present are removed. If an area of capillary oozing is identified, a small piece of Oxycel mesh is applied. The Oxycel mesh immediately adheres to the raw area and controls bleeding and is absorbed within a few days.

Most of the endoscopic sinus surgery group patients were found comfortable in the immediate postoperative period. The discomfort suffered in the Caldwell-Luc group was mainly due to the anterior nasal packing and oedema of cheek. Facial pain which is considered as a major criterion for chronic sinusitis was considerably diminished in the endoscopic sinus surgery group as compared to the Caldwell-Luc group. However, in the immediate postoperative period, some Caldwell-Luc patients complained of pain over the cheek but majority had numbness. Nasal obstruction was found to be less at all postoperative periods in FESS group compared to the Caldwell-Luc group. In the immediate postoperative period the nasal obstruction experienced by the Caldwell-Luc group may be explained by the oedema and clots in the nasal cavity. Another cause for the postoperative nasal obstruction was the formation of

crusts and synechiae. All cases of both group were subjected to endoscopic clearance of the nasal cavity after 2 weeks during which clots and small polyps were removed. Synechiae if formed was released on the same visit itself. After this procedure majority of endoscopic sinus surgery group patients had early reepithelialization of the maxillary sinus. The recurrence of symptoms after Caldwell-Luc's surgery showed good correlation with the pathology in the ethmoid which can cause narrowing or occlusion of the infundibulum. This pathology is not cleared in routine Caldwell-Luc's surgeries.

Nasal discharge was found to be more in the endoscopic sinus surgery group in the immediate postoperative period. This may be due to the reactive allergic nasal mucosal reaction to the gel foam as well as dissolution of the gel-foam inserted in the antrostomy site. At the end of 6 months, the roles were reversed as now the complaint was more in the Caldwell-Luc group even though the inferior meatal antrostomy was found to be patent. The purulent secretions are transported primarily to the natural ostium of the maxillary sinus from where some of them will slide out through the window in the inferior meatus. However, in our study there was no antrostomy stenosis.

Headache was significantly decreased in both groups postoperatively. However, as per the headache scoring system, Caldwell-Luc patients had more severe headache than endoscopic sinus surgery group. The severity was found to be gradually diminishing. In the immediate postoperative period the headache appreciated by Caldwell-Luc patients was mainly because of the packing. Postoperative neuralgias also contributed to the headache. However, in the endoscopic sinus surgery group headache was significantly reduced, as there was decrease in sinusitis, neuralgias and mucosal contacts.

Halitosis after 1 month of surgery was found to be less in the FESS group as compared to the Caldwell-Luc group. This may be due to the increase in the incidence of nasal obstruction and nasal discharge in the Caldwell-Luc group on follow up.

Anosmia was found to be the least relieved after both the surgical procedures. The may be due to the associated undetected allergy, chronic of the disease, failure to clear olfactory cleft, postoperative nasal obstruction and oedema. Some drugs used can also cause anosmia.

Improvement of ear pressure/fullness was more appreciated in the endoscopic sinus surgery group when compared to Caldwell-Luc group. The persistence of the symptom in the Caldwell-Luc group may be due to the anterior nasal packing done in all cases of Caldwell-Luc's surgery postoperatively causing Eustachian tube occlusion and due to the uncontrolled, unattended nasal allergy.

Epistaxis after 1 month of surgery was found to be more in the endoscopic sinus surgery group when compared to

Caldwell-Luc's group. This may be explained by the occurrence of crusting in the middle meatus which ends to bleed on removal frequent cleaning of the endoscopic sinus cavity is needed for restoration of the normal sinus mucosa which may result in mild epistaxis. The occurrence of epistaxis can be minimized by anaesthetizing the cavity before suction clearance, instillation of nasal drops to dislodge the crusts and careful removal of the crusts saline douches as well as intranasal corticosteroids.

Oedema of the middle meatus was found to be higher in the FESS group at the 2 weeks, which gradually subsided. On the other hand, the edema was found to be gradually increasing in the second group. This may be due to the gradual increase in nasal discharge and nasal obstruction in the Caldwell-Luc group. In cases of oedema in the middle meatus a short course of systemic steroids was tried in our study. This was followed by prolonged use of steroid spray in cases of severe nasal allergy and extensive sinonasal polyposis. The oedema significantly reduced in the FESS group, while in the Caldwell-Luc a significant number of patients had persistence of oedema. The underlying untreated diseased ethmoids and persistence of nasal allergy may be responsible for the stasis of secretions in the maxillary sinu causing recurrence of the oedema. Endoscopic assessment of the discharge in middle meatus showed initial nonsignificance, but later turning to be significant in the Caldwell-Luc group. Infracturing the inferior turbinate during inferior meatal antrostomy in the Caldwell-Luc group may result in tilting of the bony lateral wall of the nose causing further narrowing of the ethmoidal infundibulum resulting in recurrence of symptoms and signs. So in cases of obstructed natural ostia or if there is disease in the anterior in persistence of symptoms. No case of antrostomy stenosis was found in our postoperative follow up in both FESS group and Caldwell-Luc group. In the endoscopic sinus surgery group, the complications we encountered were crusting in the nasal cavity and synechia formation. The crusts were completely cleared by 6 months and the cavity was fully re-epithelialized. Synechia formation between the middle turbinate and the end of 2 weeks. We tried to decrease the incidence of synechia by the following ways. Before surgery topical anaesthesia using 4% lignocaine packing was done carefully without injuring the nasal mucosa. Adequate surgical precautions were taken so that no opposing wound surfaces were created during the surgery. Post-operative cavity was packed with gelfoam in majority of the patients. If there was oedema in the middle meatal region, local steroids were instilled in the immediate postoperative period. On the third postoperative day, the clots, secretions and crusts in the surgical site were carefully removed by suction. This prevents the formation of scabs and fibrin bridges which can later contribute to synechia formation. Other reported complications of endoscopic sinus surgery such as orbital complications, CSF leak, loss of vision, diplopia, pneumocephalus, meningitis, nasolacrimal

duct stenosis and epiphora, antrostomy stenosis never occurred in our patients. In the Caldwell-Luc group the major complications encountered were cheek oedema, infraorbital nerve numbness and neuralgias. The measures to decrease cheek oedema include careful retraction and dissection during surgery, applying continuous ice-compress over the cheek in immediate postoperative period and supplementing antioedema measures such as serratiopeptidase in the postoperative period. None of the patients of either group required revision surgery during our study period.

Conclusion

Both endoscopic middle meatal antrostomy and Caldwell-Luc's surgery are effective in the surgical management of chronic sinusitis. However, endoscopic middle meatal antrostomy is superior to Caldwell-Luc's procedure in intraoperative and postoperative parameters like patient's comfort, co-operation, per-operative bleeding, days of hospital stay, alleviation of symptoms and disease resolution by endoscopy.

Key messages

- Surgery should be considered in all cases of maxillary sinusitis unresponsive to conservative management for at least a period of 6–8 weeks
- Pre-operative nasal endoscopy and CT scan of the paranasal sinuses are essential
- Local anesthesia is ideal for most of the sinus surgeries
- Both endoscopic middle meatal antrostomy and Caldwell-Luc surgery are effective in the management of chronic sinusitis
- Better alleviation of most of the symptoms is seen in endoscopic middle meatal antrostomy.

Conflicts of interest None.

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